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ABSTRACT

The purpose of this study was to compare aspects of educational environments in elementary schools which differed in the degree to which programs were individualized flexible, and diverse; and architectures were open. Fifteen classes were assigned to the cells of a factorial design, and data on educational environments were collected from teachers and students by systematic observations, interview, and self-report procedures. Multivariate analyses of variance were conducted using both individual and aggregated scores. The study demonstrated that program openness is useful in distinguishing among educational environments. The empirical clarification of the concept was the major result of the study. (Author/MLF)

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EDUCATIONAL ENVIRONMENTS IN ELEMENTARY SCHOOLS DIFFERING IN ARCHITECTURE AND PROGRAM OPENNESS

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INTRODUCTION

The effect on behavior of the setting or environment in which the behavior takes place has long been proclaimed. Not only is the number of potentially important factors in the environment very large, but also the relations between them are highly complex. Work on the conceptualization and identification of major factors in educational environments has been relatively slow. Shulman (1970, p. 374) has noted that the "classification of environments, settings, or treatments remains relatively primative." If important dimensions of the setting or environment in which instruction takes place could be identified and indexed then the probability of conducting more fruitful classroom research would be greatly enhanced. The argument for studying situational variables has been made by Mitchell (1969, p. 696) in stating that "the determinants of behavior need to be sought more often in the characteristics of the environmental context and the interaction of these characteristics with individual traits and abilities, and that a search for individual characteristics in vacuo can lead only to partial understanding or no understanding at all." This point of view has also been expressed by Getzels and Thelen (1960), Bloom (1964), and Shulman (1970), among others and points out that the study of educational environments themselves is of great value even though the relation between treatment factors and outcome variables is of ultimate importance.

The term educational environment has been defined by Sinclair (1970, p. 54) as the "conditions, forces and external stimuli that foster the development of individual characteristics." A wide range of environmental

variables are suggested by the following questions. What activities do students engage in? How often do students engage in any particular activity? What sizes of social and activity groups are formed in schools? How do students perceive the social climate in instructional settings?

It is reasonable to assume that educational environments will differ among schools having different programs. Although school programs differ on many dimensions, it is possible to order programs in terms of the extent to which they are individualized, flexible, diverse, and directly influenced by students. These dimensions of instructional programs have received a great deal of attention in recent years (see, for example, Central Advisory Council for Education, 1967; Featherstone, 1967a, b, c; Barth, 1969; Kohl, 1969; Bussis & Chittenden, 1970; and Silberman, Allender, & Yanoff, 1972 among others) and although there is very little research evidence to go on, this cluster of variables is likely to remain the center of considerable activity for some time. These and other program facets have been included in the concept of program openness described by Traub, Weiss, Fisher and Musella (1972). The major goal of this study was to characterize educational environments as a function of program openness.

The physical setting in which instruction takes place can also be expected to affect the educational environment. In recent years the construction of school buildings has undergone radical change. Whereas the majority of schools has self-contained classrooms designed to house one teacher and approximately thirty students, many new schools are built on, what is referred to as the "open plan." The open plan or open space schools have a minimum of interior construction and allow several teachers and up to several hundred students to work within sight and sound of one

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another. Although open space schools are often built to complement a relatively open program, the two notions are conceptually independent.

The overall purpose of this study was to compare aspects of the educational environments in elementary schools differing in program openness and architectual type.

METHOD

Independent Variables

Program Openness. The concept of program openness used in this study is that described by Traub, et al. (1972). Characteristics relating to open education were identified in ten program areas (setting instructional objectives, materials and activities, physical environment, structure of decision making, time scheduling, individualization for learning, composition of classes, role of teacher, student evaluation, and student control). Each characteristic exhibited several alternative program possibilities which (1) could be ordered with respect to openness and (2) did not contradict the assumptions underlying open education as presented by Barth (1969). These characteristics were used to develop a twenty-nine item paper and pencil instrument for quantifying the openness of programs. The instrument entitled The Dimensions of Schooling (DISC) was designed for use in elementary schools. High scores on DISC are associated with programs that have relatively high diversity, flexibility, and influence from students. In order to exclude possible subject area effects, the present study was conducted in the context of language arts [illegible]. Teachers' scores corresponding to the aggregated responses to twenty-two items of DISC, collected specifically for the language arts area, were used as the index of program openness.

Architecture. Teachers and students worked in one of two distinctly different architectural settings. Instruction areas that were self-contained were designated closed-space architecture. Instructional areas which were not divided by interior walls, and in which many students and several teachers worked within sight and sound of one another were designated open space architecture.

Subjects

Two months after the beginning of the school year, DISC scores were obtained for all language arts teachers of eleven year old students in 30 elementary schools in one school system in southern Ontario. The internal consistency of the 68 scores in the distribution was 0.76; the mean and standard deviation were 10.7 and 2.3 respectively. Fifteen teachers whose scores were in the tails of this distribution were subsequently interviewed in April of the same school year. During the interview their DISC scores were reassessed. The correlation between the November and April DISC scores was 0.75. On the basis of the April DISC scores, the fifteen teachers were placed in the cells of a 2x3 matrix (Table 1). When considered in the framework of Table 1 the teachers were homogeneous on a number of background characteristics including age, number of years teaching experience, years of formal education after secondary school, and number of years in present school.

From the language arts instruction groups of each of the fifteen teachers, six students were chosen--three boys and three girls. The students were relatively homogeneous on a number of background variables including age, percent of students living with both parents, percent of students from homes with English as the major language, and socioeconomic

TABLE 1

Marginal and Cell Means on Program Openness

Architectural Type	Program Openness: low	medium	high	
closed space	7.3 (N=7)	10.6 (N=2)		8.0
open space	8.8 (N=1)	12.2 (N=3)	17.7 (N=2)	13.5
	7.5	11.6	17.7	

status. Our exception to this pattern appeared in the verbal scores of a general ability test (SCAT, series II). The mean score for students in the open space medium program openness combination was lower than the means of the other four combinations. Since the dependent variables consisted entirely of transaction variables (as opposed to achievement variables) the result for the verbal scores was not considered especially serious.

Dependent Variables

The selection of the dependent variables attempted to accommodate several concerns. Information was collected from both teachers and students on variables describing the instructional setting, perceptions of the setting, and behaviors in the setting. An attempt was made to choose variables which in a psychological sense, were as simple as possible.

Social climate. Nine aspects of social climate which either had been useful in previous research or related to descriptions of open education were chosen; they included indices of instructional pace, formality, diversity, democracy, competition, environment, friction, difficulty, and satisfaction. The measures of social climate gave information about the interpersonal relationships among students in the instructional group, relationships between the students and their teachers, relationships between students and the learning conditions, and the structural properties of the group. The measure of social climate used was the My Language Arts Class Questionnaire (MLAC) which was adapted from the Learning Environment Inventory (Walberg & Anderson, 1968; Anderson, 1971). MLAC contains 85 items distributed on nine scales. Subjects responded to each item on a four point scale depending upon how well that

item described their instructional group. Internal consistency for the scales ranged between 0.50 and 0.86. Both students and teachers responded to MLAC. Teacher and student scores on the nine MLAC scales constituted the description of the social climate.

Observation of student and teacher behavior. The second set of descriptors of the educational environment consisted of a variety of indices obtained by direct observation of students and teachers. The observation procedure (Fisher, 1973) provided the following information on teachers: average number of students engaged; a rating on direction reflecting the amount of disciplinary control that teachers exercised over students; and relative frequencies for various categories of teacher's physical position, activity, and use of materials. The information on individual students included social group size, activity group size, proximity to teacher, and relative frequencies associated with categories of position, activity and use of materials. The basic student observation data consisted of scores for ninety students on nineteen variables while the basic teacher observation data consisted of scores for each of the fifteen teachers on nineteen variables. Table 2 summarizes the variables assessed in the observation procedure. Each teacher-student group was observed by trained observers on five one-hour occasions over a period of six weeks.

In order to assess the reliability of the scores yielded by the observation procedure two estimates of each score were obtained by using first the even numbered observations and then the odd numbered observations. The correlations between these odd observation and even observation scores ranged from 0.46 to 1.00 with twenty-seven of the thirty-eight coefficients exceeding 0.80.

TABLE 2

Student and Teacher Variables Assessed by Observation

Student Variables	
Social group size	(number of students in a face to face group)
Activity group size	(number of students working on the same activity)
Proximity to teacher	(scaled from "touching" to "beyond arm's reach")
Position I	(seated)
Position II	(standing or on the floor)
Position III	(out of the room, other)
Activity I	(unengaged)
Activity II	(reading)
Activity III	(paper and pencil seatwork)
Activity IV	(construction activity, game playing, working at a blackboard, watching and/or listening to audio-visual equipment, and other)
Activity VI	(in transit)
Activity VII	(watching/listening to teacher)
Activity VIII	(watching/listening to students)
Activity X	(speaking to students)
Material I	(printed material)
Material II	(writing instruments)
Material III	(visual projectors, audio-equipment, hand tools, construction materials, games)
Material IV	(blackboard, maps, charts, other)
Material V	(writing paper)

Table 2 - continued

Teacher Variables	
Number of students engaged	(number of students to whom the teacher directs attention or communication)
Direction	(rating of amount of disciplinary control exercised over students)
Position I[1]	
Position II	
Position III	
Activity I	(giving directions)
Activity II	(listening to student presentations)
Activity III	(working alone)
Activity IV	(observing students in groups)
Activity V	(recitation)
Activity VI	(small group consultation)
Activity VII	(lecturing, dictation, other)
Activity VIII	(maintenance)
Activity IX	(marking seatwork)
Material I[2]	
Material II	
Material III	
Material IV	
Material V	

NOTE: Two students categories (Activity V and Activity IX) had near zero frequencies and were dropped from further consideration.

1. The categories of teacher position were identical to the categories of student position.

2. The categories of teacher materials were identical to the categories of student materials.

Data Analysis

Two data matrices, one containing student scores and one containing teacher scores constituted the input to the analysis. Both matrices contained scores on nineteen variables collected by observation and nine social climate variables collected by self-report.

The variables in the form of relative frequencies were subjected to an arcsine transformation in order to reduce skew and increase homogeniety of variance. These same variables which were derived from mutually exclusive categories constituted ipsative sets. In general, one variable from each ipsative set was omitted from the analyses in order to avoid at least some of the problems associated with linear dependency.

The dependent variables were analyzed in a 3x2 (three levels of program openness and two levels of architecture) design. Multivariate analyses of variance (Finn, 1971) were carried out on individual scores and on scores aggregated for each instructional group. The four degrees of freedom for estimating effects were separated into single degree of freedom contrasts. A linear and a quadratic effect for the program openness factor, an architecture effect and an interaction effect were estimated.

A secondary analysis examined the relationship between the teacher student variables. For this purpose the principal components of the correlation matrix for student and teacher variables were computed.

RESULTS

Student Variables

The student variables were analyzed in five separate sets: groups sizes, categories of position, activity, and materials, and social climate variables. Results based upon individual student scores are shown in Table 3. Those contrasts which reached significance when the analyses were based on aggregated student scores are indicated by bracketed symbols.

The results for group sizes were strongest for the quadratic program contrast. For both social and activity group sizes the students in the medium level of program openness had lower scores than the averages of the students in the other two levels. For activity group size this result was confirmed by the analysis based on aggregated student scores. A weaker result on the architecture contrast indicated that students in open space settings worked in smaller activity groups than students in closed space settings.

Although there was an indication that students in the medium level of program openness had higher scores on position II (standing and on the floor) than students in the low and high levels combined, the major results for the categories of position occurred on the architecture contrast. Students in open space settings had higher scores on both position II (standing and on the floor) and position III (out of the room and other) than students in closed space settings. These results for the architecture contrast occurred in both the analysis based on individual students scores and aggregated student scores.

For the categories of activity there were significant results on all of the contrasts for main effects. For the architecture contrast students in open space settings had higher scores on activity I (unengaged) and activity VI (in transit) and lower scores on activity VIII (watching and/or listening to students) than students in closed space settings. However the strongest and greatest number of effects for the categories of activity occurred on the linear program contrast. Student scores on activity IV (diverse activities including construction activity, game playing, working at a blackgoard, and using audiovisual equipment) and activity VI (in transit) were positively related and scores on activity II (reading), activity VII (watching and/or listening to students) were negatively related to program openness. Two of these results (those for activity IV and activity VI) were confirmed in the analysis based on aggregated student scores. In addition, students in the low and high levels combined had higher scores on activity IV and activity II (reading) but lower scores on activity I (engaged) and activity X (speaking to another student or students). It is interesting to note that no significant differences in activity III (paper and pencil seatwork) were related to either of the independent variables.

For the categories of material, the strongest results were associated with the linear program contrast. Student scores on material I (printed materials) were negatively related and scores on material III (visual projectors, audio equipment, handtools, construction materials, and games) and material V (writing paper) were positively related to program openness. In addition students in the medium level of program openness had higher scores on material I

TABLE 3
Part A

MANOVA Results for Student Group Sizes

		CONTRASTS			
		Main Effects			
		I Program (Linear)	II Program (Quadratic)	III Open Arch. vs. Closed Arch.	Interaction
Univariate Analysis	*df*	1,85	1,85	1,85	1,85
Social Group Size	*Direction*		Low + High		
	F Ratio[1]	NS	9.16**	NS	NS
			2.04/3.39		
Activity Group Size	*Direction*		Low + High	Closed Arch.	
	F Ratio	NS	73.05**(**)[2]	3.96*	NS
			6.13/3.60	2.03/3.60	
Multivariate Analysis	*df*	2,84	2,84	2,84	2,84
	F	NS	36.46**(*)	NS	NS

[1] In all analysis of variance tables the numerator of the ratio reported is the least squares estimated effect for the contrast, the denominator is the standard deviation for the variable found by pooling within cells variation.

[2] Symbols in brackets denote significance levels of results obtained from an analysis of aggregated student scores..

*p .05.

**p .01.

TABLE 3

Part B

MANOVA Results for the Categories of Position

		CONTRASTS			
		Main Effects			
		I Program (Linear)	II Program (Quadratic)	III Open Arch. vs. Closed Arch.	Interaction
Univariate Analysis	*df*	1,85	1,85	1,85	1,85
Position II *(standing, on the floor)*	*Direction* *F* *Ratio*	NS	Medium 9.08** .19/.31	Open Arch. 35.14** (*) .52/.31	NS
Position III *(out of the room, other)*	*Direction* *F* *Ratio*	NS	NS	Open Arch. 34.39** (**) .37/.32	NS
Multivariate Analysis	*df* *F*	2,84 NS	2,84 5.28**	2,84 33.77** (*)	2,84 NS

TABLE 3

Part C

MANOVA Results for the Categories of Activities

			CONTRASTS			
			Main Effects			
			I	II	III	Interaction
			Program (Linear)	Program (Quadratic)	Open Arch. vs. Closed Arch.	
Univariate Analysis		*df*	1,85	1,85	1,85	1,85
Activity I	*(unengaged)*	*Direction*		Low + High	Open Arch.	
		F Ratio	NS	10.76**(*) 0.12/0.19	4.56* 0.11/0.19	NS
Activity II	*(reading)*	*Direction*	Negative	Medium		
		F Ratio	4.84* 0.26/0.25	11.73** 0.17/0.25	NS	NS
Activity III	*(paper and pencil seatwork)*	*Direction*				
		F Ratio	NS	NS	NS	NS
Activity IV[1]		*Direction*	Positive	Medium		
		F Ratio	53.37**(**) 0.34/0.16	4.43* 0.07/0.16	NS	NS
Activity VI	*(in transit)*	*Direction*	Positive		Open Arch.	
		F Ratio	9.71**(*) 0.10/0.11	NS	24.09**(**) 0.15/0.11	NS
Activity VII	*(watching/ listening to teacher)*	*Direction*	Negative			
		F Ratio	5.08* 0.11/0.17	NS	NS	NS
Activity VIII	*(watching/ listening to students)*	*Direction*	Negative		Closed Arch.	
		F Ratio	16.57** 0.28/0.24	NS	7.40** 0.18/0.24	NS
Activity X	*(speaking to students)*	*Direction*		Low + High		
		F Ratio	NS	9.13** 0.11/0.18	NS	NS
	Multivariate Analysis	*df*	8,78	8,78	8,78	8,78
		P	12.98**	4.85**	5.89**	NS

[1]Activity IV included categories labelled construction activity, game playing, working at a blackboard, watching and/or listening to audiovisual equipment, and other.

TABLE 3

Part D

MANOVA Results for the Categories of Material

		CONTRASTS			
		Main Effects			
		I Program (Linear)	II Program (Quadratic)	Open Arch. vs. Closed Arch.	Interaction
Univariate Analysis	*df* -	1,85	1,85	1,85	1,85
Material I *(printed material)*	*Direction*	Negative	Medium		
	F Ratio	22.28** .44/.32	4.40* .14/.32	NS	NS
Material III[a]	*Direction*	Positive		Open Arch.	
	F Ratio	19.47**(*) .29/.23	NS	11.68** .22/.23	NS
Material IV *(blackboard, maps, charts, other)*	*Direction*			Closed Arch.	
	F Ratio	NS	NS	9.52** .15/.17	NS
Material V *(writing paper)*	*Direction*	Positive			
	F Ratio	4.32* .14/.24	NS	NS	NS
Multivariate Analysis	*df*	4,82	4,82	4,82	4,82
	F	9.92**	2.84*	5.23**	NS

[a]Material III included categories labelled visual projectors, audio equipment, handtools, construction materials, games.

TABLE 3

Part E

MANOVA Results for Social Climate Variables

		CONTRASTS			
		Main Effects			
		I Program (Linear)	II Program (Quadratic)	III Open Arch. vs. Closed Arch.	Interaction
Univariate Analysis	*df*	1,85	1,85	1,85	1,85
Diversity	*Direction*	Positive		Open Arch.	
	F Ratio	8.45** 3.76/4.49	NS	4.21* 2.61/4.49	NS
Formality	*Direction*	Negative	Medium		
	F Ratio	8.53** 3.20/3.81	6.06* 1.87/3.81	NS	NS
Difficulty	*Direction*				
	F Ratio	NS	NS	NS	NS
Environment	*Direction*		Medium		
	F Ratio	NS	15.38** 3.31/4.24	NS	NS
Pace	*Direction*			Open Arch.	
	F Ratio	NS	NS	6.37* 2.19/3.0[illegible]	NS
Democracy	*Direction*				
	F Ratio	NS	NS	NS	NS
Competition	*Direction*				
	F Ratio	NS	NS	NS	NS
Satisfaction	*Direction*		Medium		
	F Ratio	NS	9.27** 3.12/5.15	NS	NS
Friction	*Direction*			Open Arch.	
	F Ratio	NS	NS	11.24** 5.65/5.95	NS
Multivariate Analysis	*df*	9,77	9,77	9,77	9,77
	F	2.12*	4.21**	2.20*	NS

(printed material) than students in the low and high levels combined. Students in open space settings when compared to students in closed space settings had higher scores on material III (visual projectors, audio equipment, handtools, construction materials, and games) and lower scores on material IV (blackboard, maps, charts and other).

On three of the social climate scales, difficulty, democracy, and competition, there were no significant differences related to either of the independent variables. However, student scores on diversity were positively related and scores on formality were negatively related to program openness. Students in the medium level of program openness had higher scores on formality, environment, and satisfaction when compared to students in the low and high levels combined. In addition, students in open space settings when compared to students in closed space settings had higher scores on diversity, pace, and friction.

Teacher Variables

Univariate results for the teacher variables are reported in Table 4. Since the sample of teachers was small, multivariate tests were of little utility.

For the teacher variables, nine of the eleven main effects which reached significance were associated with the linear program contrast. Teacher scores on number of students engaged, activity I (giving directions), activity V (recitation), activity VIII (maintenance), formality, competition and friction were negatively related while scores on activity VI (small group conulstation) and democracy were positively related to program openness scores. Teachers in the medium level of program openness scored higher on activity I (giving directions) than teachers in the low and high levels combined. Teachers in open space settings scored higher on

TABLE 4

ANOVA Results for Teacher Variables

		CONTRASTS			
		Main Effects			
		I Program (Linear)	II Program (Quadratic)	III Open Arch. vs. Closed Arch.	Interaction
Univariate Analysis	*df*	1,10	1,10	1,10	1,10
Number of Students Engaged	*Direction*	Negative			
	F Ratio	6.43* 5.86/3.28	NS	NS	NS
Direction	*Direction*				
	F Ratio	NS	NS	NS	NS
Position II *(standing, on the floor)*	*Direction*				
	F Ratio	NS	NS	NS	NS
Position III *(out of the room, other)*	*Direction*				
	F Ratio	NS	NS	NS	NS
Activity I *(giving directions)*	*Direction*	Negative	Medium		
	F Ratio	17.41** 0.27/0.09	6.61* 0.12/0.09	NS	6.17*
Activity II *(listening to student presentations)*	*Direction*				
	F Ratio	NS	NS	NS	NS
Activity III *(working alone)*	*Direction*				
	F Ratio	NS	NS	NS	NS
Activity IV *(observing students in groups)*	*Direction*				
	F Ratio	NS	NS	NS	NS
Activity V *(recitation)*	*Direction*	Negative			
	F Ratio	7.09* .57/0.30	NS	NS	NS
Activity VI *(small group consultati--)*	*Direction*	Positive			
	F Ratio	20.69** 0.65/0.20	NS	NS	6.56*

TABLE 4.--Continued

			CONTRASTS			
			Main Effects			
			I Program (Linear)	II Program (Quadratic)	III Open Arch. vs. Closed Arch.	Interaction
Activity VII	*(lecturing, dictation, other)*	*Direction*	NS	NS	NS	NS
		F Ratio				
Activity VIII	*(maintenance)*	*Direction*	Negative		Open Arch.	
		F	12.24**	NS	23.41**	NS
		Ratio	0.26/0.10		0.35/0.10	
Activity IX	*(marking seatwork)*	*Direction*	NS	NS	NS	NS
		F Ratio				
Material I	*(printed material)*	*Direction*	NS	NS	NS	NS
		F Ratio				
Material III[a]		*Direction*	NS	NS	NS	NS
		F Ratio				
Material IV	*(blackboard, maps, charts, other)*	*Direction*	NS	NS	NS	NS
		F Ratio				
Material V	*(writing paper)*	*Direction*	NS	NS	NS	NS
		F Ratio				
Diversity		*Direction*	NS	NS	NS	NS
		F Ratio				
Formality		*Direction*	Negative			
		F	14.77**	NS	NS	NS
		Ratio	7.16/2.64			
Difficulty		*Direction*	NS	NS	NS	NS
		F Ratio				
Environment		*Direction*	NS	NS	NS	NS
		F Ratio				

TABLE 4--Continued

		CONTRAST			
		Main Effects			
		I Program (Linear)	II Program (Quadratic)	III Open Arch. vs. Closed Arch.	Interaction
Pace	*Direction*	NS	NS	NS	NS
	F Ratio				
Democracy	*Direction*	Positive			
	F Ratio	7.63* 7.64/3.92	NS	NS	NS
Competition	*Direction*	Negative			
	F Ratio	7.45* 8.17/4.19	NS	NS	NS
Satisfaction	*Direction*	NS	NS	NS	NS
	F Ratio				
Friction	*Direction*	Negative			
	F Ratio	6.48* 8.81/4.91	NS	NS	NS

[a]Material III included categories labelled visual projectors, audio equipment, handtools, construction materials, and games.

activity VIII (maintenance) than those in closed space settings. No significant differences were associated with either the categories of position or the categories of material. Three interactions reached significance (activity I, activity VI, and friction) however the interpretation of significant main effects was not impaired.

The potency of the program factor in the data on teachers was clear from the analysis of variance results. This potency was underscored by the fact that on 26 of the 28 teachers variables, the mean for the medium level of program openness was between the means for the low and high levels of program openness.

Relationships Among the Variables

The environmental indices employed in the study were substantially intercorrelated. When the indices were considered jointly (both student and teacher variables) the axis which accounted for maximum variance was highly correlated ($r = 0.93$) with the measure of program openness (see Table 5). Approximately 30% of the total variance in the indices was associated with the first principal component and hence with program openness. Instructional groups situated near the positive extreme of the first principal component were characterized by teachers who engaged small numbers of students, gave relatively few explicit directions and were away from their instructional areas relatively often. These teachers engaged in small group consultation frequently but listened to student presentations and engaged in recitation sessions infrequently. They considered their classes to be diverse, informal, individually paced, non-competitive and satisfying. Students in these groups tended to be standing, on the floor, and away from the class area frequently. They

tended to be unengaged, in transit, and working at diverse activities including construction activities, game playing, working at a blackboard, and watching and/or listening to audiovisual equipment relatively often. Students watched and listened to the teacher and other students relatively infrequently, and visual projectors, audio equipment, handtools, construction materials and games were often in use. The social climate of the instructional group was perceived by the students to be diverse and individually paced. Instructional groups of this type tended to be found in open space settings. These characteristics distinguished between educational environments varying in general program openness. The instructional group described was operating in a relatively open environment. The characteristics of an instructional group working in a less open environment are described by interpreting the same variables with reversed polarities.

The second principal component accounted for approximately 10% of the total variance associated with the environmental indices. An instructional group located near the positive end of this axis was characterized in the following manner. Both teacher and students used printed material relatively often, used writing materials relatively infrequently and perceived the work to be individually paced. Students frequently engaged in reading, and worked in small activity groups in relatively close prosimity to the teacher. These students tended to use blackboards, maps and charts infrequently. This set of variables distinguished between environments in which small groups pursued individually paced reading activities and environments in which little reading was done and the work was paced

TABLE 5

Principal Components[1] of Environmental Variables

	Variables	Principal Components I	II	III
	Program Openness	90	-05	22
	Architectural Openness	85	02	00
Teacher Variables	Number of Students Engaged	-76	-03	-29
	Direction	-61	05	21
	Position II	-47	39	-06
	Position III	76	-22	-12
	Activity I	-77	30	05
	Activity II	-59	09	05
	Activity III	39	-45	-14
	Activity IV	-20	-44	23
	Activity V	-67	38	04
	Activity VI	79	06	-03
	Activity VII	57	-04	13
	Activity VIII	23	14	-58
	Material I	-47	60	-26
	Material III	47	03	03
	Material IV	-02	-19	16
	Material V	36	-51	21
	Diversity	70	27	31
	Formality	-76	-01	-20
	Difficulty	-07	03	-69
	Environment	41	-11	70
	Pace	60	56	25
	Democracy	51	-09	35
	Competition	-81	01	01
	Satisfaction	59	-37	41
	Friction	-35	45	-48
Student Variables	Social Group Size	-42	-21	-33
	Activity Group Size	-24	-55	-39
	Proximity	-23	-51	-32
	Position II	59	-07	16
	Position III	53	-28	28
	Activity I	55	-19	-34
	Activity II	-15	79	-07
	Activity III	09	07	-24
	Activity IV	77	10	36
	Activity VI	85	-19	18
	Activity VII	-54	-11	12
	Activity VIII	-72	-28	04
	Activity X	35	-41	-31
	Material I	-43	80	-12
	Material III	92	03	02
	Material IV	-26	-52	40
	Material V	09	-78	02
	Diversity	74	46	28
	Formality	-34	07	14
	Difficulty	-12	68	-15
	Environment	18	-10	82
	Pace	60	68	-05
	Democracy	15	-08	71
	Competition	03	34	-08
	Satisfaction	28	13	77
	Friction	--	1	-1
	Percent of Variance Accounted For	29	13	11

[1]The principal components have been subjected to a varimax rotation.

NOTE--Decimal points have been omitted from the table.

for the group as a whole. The linear combination of variables which distinguished individual reading programs was independent of the general openness of the instructional group.

Approximately 10% of the total variance was accounted for by the third principal component. The variables which correlated highly with this axis distinguished between environments differing in perceived social climate. Positive social climates were perceived by teachers as having pleasant physical surroundings, adequate work space, and accessible materials. Teachers perceived the level of difficulty of the student activities to be low and tended to engage in maintenance activity infrequently. Positive social climates were perceived by students to have pleasant physical surroundings, adequate work space, accessible materials and low interpersonal friction. In addition, students perceived these settings as democratic and satisfying.

The three principal components, identified as general program openness, individual reading programs, and positive social climate, accounted for 53.1% of the variance in the full set of variables. Of these, the components labelled general program openness was by far the most important, in fact, it involved the largest number of variables and accounted for the greatest portion of the total variance.

DISCUSSION

The clearest result of the study indicated that the educational environments of instructional groups which differed in program openness and architecture type were distinctly different. Evidence for this result was provided by the analyses of variance performed on the student data.

The measure of program openness (DISC) has been validated, to some extent, by the findings of this study. Significant differences were found on a variety of variables between groups of teachers that differed on program openness as measured by DISC. The direction associated with the differences was consistent with expectations generated in the description of the concept. For example, teachers in more open programs engaged fewer students on the average, and consulted with small groups of students more often than teachers in less open programs. The remarkably consistent trend in the data on teachers, when considered by levels of DISC, provided further evidence for the validity of the program measure. The empirical clarification of program openness, in terms of teacher and student environmental attributes with which it was closely linked, was the major result of the study.

The relationship of a number of variables to what was labelled general program openness was summarized by a principal component analysis. In the instructional groups that were studied, approximately 30% of the variance in environmental indices was associated with general program openness. Although the potency of the concept in accounting for student outcomes has yet to be generalized, this study has shown that program openness is a useful dimension upon which to distinguish among educational environments.

Large additional portions of the total variance in the environmental indices were associated with components labelled individual reading program and positive social climate. Since the number of instructional groups involved in the study was small, it was possible that each of these components was trivial. This would have been the case if each of the components described a pair of instructional groups extremely well, while being, more or less, independent of the remaining instructional groups. This possibility was not borne out by inspection of the scores for individual groups.

It is interesting, and somewhat surprising, that the individual reading program component was unrelated to program openness. This fact may have implications for DISC, the instrument used to measure program openness. The lack of relationship is surprising, in that, several items in DISC are designed to reflect the extent of individualization of instruction. The apparent success of DISC in this respect has been noted earlier. Nonetheless, the individual reading program component was highly correlated with teacher and student perceptions of pace, activity group size and proximity of teacher and students. Two factors contributed to this apparent inconsistency.

Teacher and student perceptions of pace were highly correlated with both the individual reading program and the general program openness components. Hence the individualization facet was commong to both components.

The individual reading program component was strongly influenced by the student reading variable and the variables associated with categories of material used by both teachers and students. In

instructional groups where students spent relatively large amounts of time reading printed materials, the other categories of material tended to be used relatively infrequently. Teachers in these instructional groups tended to use materials in a similar way. The lack of relation between the individual reading program component and scores on DISC was probably due to the fact that DISC does not assess the use of materials as they were defined in this study. In addition, the prominence of the reading variable may have been artifactual, since the study was conducted in language arts instruction groups.

The positive social climate component was also relatively independent of DISC. In this case, the lack of a strong relationship was more easily explained. An analysis of the content of DISC indicated that there were no items dealing with the affective aspects of instructional environments. Inclusion of items of this type would probably improve the content validity of DISC, in that, affective concerns are frequently raised in the literature on open education (see, for example, Bussis & Chittenden, 1970; Rathbone, 1972).

The principal components constitute a useful summarization of the environmental indices considered in the study. However their derivation and interpretation must be considered suggestive for two reasons. First, complex relationships were introduced into the correlation matrix by the ipsative properties of some of the variables obtained by observation. Second, the correlations were based on data from only 15 instructional groups.

In the analysis of variance results, significant differences were often associated with the quadratic program contrast. Initially this

situation seemed to constitute an interesting and important finding, however several considerations cast doubt on its validity. The strongest of these lies in the fact that elevent of the twelve measures for which significant quadratic effects occurred, were student variables. The fact that students in the open program condition had significantly lower scores on a general verbal ability test, may have influenced the quadratic program contrast. Although quadratic program effects were discounted in this study, the possibility of "real" nonlinear program effects is intriguing.

The findings of the study must be qualified for several reasons. Since there was no randomization of either teachers or students to the various treatment combinations, no inferences may be made beyond those persons for whom data were collected. All students in the study were approximately elevent years old and all data were collected in the context of language arts instruction. It is not clear whether similar results would be found for students of different age levels or for instruction in subject areas other than language arts. Another limitation on the study concerns the number of participating instructional groups. Since the number of groups was small, the statistical power of the analytical procedures was low.

The fact that the independent variables were confounded in the design represents a major limitation of the study. The confounding occurred because the indices of program openness obtained in November differed from those obtained four months later. Although the two sets of scores were highly intercorrelated, it is probable that the difference between

the sets was not entirely accounted for by either unreliability or regression toward the mean. The change in program openness indices caused some difficulty in the study but it also raised several questions about the stability of school programs. Although it was not investigated in the present study, it is possible that program openness changes predictability within the school year. For example, if periodic examinations were imposed, then the openness of programs might vary in correspondence to the timing of such examinations. Similarly, program openness might fluctuate measurably near weekends or extended holidays. Systematic changes may occur over longer time spans as well. The stability of school programs during the first few years of operation of new schools may also prove to be important. These questions raise a number of practical and theoretical issues which could form the basis for further research. The usefulness of the concept of program openness will depend, to some extent, on the answers to these "stability" questions.

The present study did not involve the collection of data on student outcome variables. Clearly the utility of the results will not be clarified until the relationship between various educational environments and student outcome variables are studied.

The question regarding what level of program openness produces optimum conditions for learning is still open.

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